

**Instructional Example of
How to Write a
Web Service Description Document (WSDD)
for RESTful Services**



DRAFT

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Foreword

This document was developed to aid in understanding the process of documenting [REST-based services](#) and to provide a potential model to follow when writing [Web Service Description Documents \(WSDDs\)](#) for these services.

The adoption of [SOA](#) design principles in the FAA has led many NAS programs to Web-enable their business applications and to adopt Web-related standards in their middleware solutions. Remote Procedure Call (RPC) style [Web Services](#) was the first popular paradigm for realizing SOA in the context of the NAS; however, Representational State Transfer (REST) is now gaining broad acceptance as a simpler and light-weight alternative to RPC-based Web services.

One of the most important ingredients for interaction among components in a SOA environment is a service description. The [SWIM Controlled Vocabulary](#) defines a service description as "information needed in order to use, or consider using, a service." FAA has developed standard FAA-STD-065A, *Preparation of Web Service Description Documents (WSDD)* [3], as well as an [instructional example](#) of a WSDD for a fictitious "Flight Plan Service (FPS)" implemented as an "traditional" Web service. (The requirements for the fictitious FPS were provided in [another instructional example](#) written in accordance with FAA-STD-070, *Preparation of Web Service Requirements Documents* [4].)

This document uses the same set of functional and non-functional requirements that the original WSDD example used, but it implements them by deploying REST as an architectural approach. It is important to bear in mind that this document does not attempt to model or provide instructions for developing a REST-based ("RESTful") service, but solely focuses on how to document a RESTful service in the context of a WSDD. Therefore, while an effort was made to present a realistic picture of an air traffic control (ATC) service that could be developed to support flight planning, a number of logical and technical components that a "real" service may require were purposely omitted to make it easier for a reader to perceive or understand the major notions presented in FAA-STD-065A. For example, this document avoid using a scenario in which the service consumer interacts with a service provider in an [Enterprise Service Bus \(ESB\)](#)-brokered environment, the technological solution for today's [NAS Enterprise Messaging Service \(NEMS\)](#)-based implementations.

To make the example complete, this document includes "Flight Plan Exchange Model" (FPXM), also fictitious model for distribution of [flight plan](#) data in digital format. FPXM, a very downscaled emulation of an information exchange model such as: FIXM, AIXM and other, was expressly made for this example; it does not represent any actual model or artifacts developed or being developed by FAA and should not be used for any purpose except as an instructional aide.

Typographical Conventions used in the Instructional Example

Page headers, page numbers, figure and table captions, etc. are in accordance with FAA-STD-065A Section 4, General Requirements [\[3\]](#).

Instances of shaded and bordered paragraphs (like this) that appear at various points in the example represent **explanatory notes** that would not appear in an actual WSDD.

The examples of code, and artifacts used by FPS are presented in constant width font.



U.S. Department
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**Federal Aviation
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Web Service Description Document

Flight Plan Service (FPS)

Web Service Description Document
Flight Plan Service (FPS)

Approval Signatures

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Table of Contents

1	Scope	1
1.1	Background.....	1
2	Applicable Documents	2
2.1	Government Documents.....	2
2.2	Non-Government Standards and Other Publications	2
3	Definitions	4
3.1	Terms and Definitions	4
3.2	Acronyms and Abbreviations	7
4	Service Profile	10
4.1	Service Provider.....	10
4.1.1	Point of Contact.....	10
4.2	Service Consumers	11
4.2.1	Traffic Modernization Program (TMP).....	11
4.2.2	Alpha Airline.....	11
4.3	Service Functionality	11
4.4	Security	12
4.4.1	Security Policies.....	12
4.4.2	Security Mechanisms	12
4.4.2.1	Authentication	12
4.4.2.2	Authorization	12
4.4.2.3	Integrity	13
4.4.2.4	Non-repudiation	13
4.4.2.5	Auditing.....	13
4.5	Qualities of Service.....	14
4.6	Service Policies.....	14
4.7	Environmental Constraints	14
5	Service Interface.....	15
5.1	Interfaces	15
5.2	Operations	15
5.2.1	FileFlightPlan.....	15
5.2.1.1	Example of Code	16
5.2.2	RetrieveFlightPlan	17
5.2.2.1	Example of Code	18
5.2.3	UpdateDestinationAerodrome.....	19
5.2.3.1	Example of Code	20
5.2.4	CancelFlightPlan.....	21
5.2.4.1	Example of Code	22
5.3	Messages.....	22
5.3.1	FileFlightPlanRequest	22
5.3.2	FileFlightPlanResponse	22
5.3.3	RetrieveFlightPlanRequest.....	23
5.3.4	RetrieveFlightPlanResponse.....	23
5.3.5	UpdateDestinationAerodromeRequest	23
5.3.6	UpdateDestinationAerodromeResponse	24
5.3.7	CancelFlightPlanRequest	24
5.3.8	CancelFlightPlanResponse	24

5.4	Faults.....	25
5.5	Data Elements.....	25
5.6	Machine-Processable Service Description Document	31
6	Service Implementation	32
6.1	Bindings	32
6.1.1	Binding “RESTFlightPlanBinding”	32
6.1.1.1	<i>Data Protocol</i>	32
6.1.1.2	<i>Message Protocol</i>	32
6.1.1.3	<i>Transport Protocol</i>	32
6.2	End Points.....	32
6.2.1	End Point “HTTPFlightPlanEndPoint”	32
7	Appendixes	33
	Appendix A. Schema of XML Representation - fpxm.xsd.....	33
	Appendix B. Schema of XML Representation - diagram	37
	Appendix C. Example of XML Representation of the Flight Plan Resource	39
	Appendix D. WADL Document for FPS - fps.wadl	40
	Appendix E. WSDL Document for FPS - fps.wsdl	43

List of Figures

Figure 1-1	Architecture of FPS Environment	1
Figure 4-1	FPS Roles Use Case Diagram	13
Figure 5-1	Operation FileFlightPlan Sequence Diagram.....	15
Figure 5-2	Operation RetrieveFlightPlan Sequence Diagram	17
Figure 5-3	Operation UpdateDestinationAerodrome Sequence Diagram.....	19
Figure 5-4	Operation CancelFlightPlan Sequence Diagram	21
Figure 5-5	Flight Plan Exchange Conceptual Model	26

List of Tables

Table 4-1	FPS Business Functions	11
Table 4-2	FPS Roles	12
Table 4-3	FPS Quality of Service Requirements.....	14
Table 5-1	FPS Interface Description.....	15
Table 5-2	Operation FileFlightPlan	16
Table 5-3	Operation RetrieveFlightPlan.....	17
Table 5-4	Operation UpdateDestinationAerodrome	19
Table 5-5	Operation CancelFlightPlan.....	21
Table 5-7	FPS Fault Messages	25
Table 5-8	Selected Flight Plan Data Elements	27

1 Scope

This [Web Service Description Document \(WSDD\)](#) provides a [description](#) of the Flight Plan Service (FPS). This [service](#) gives a [service consumer](#) the capability to [file](#), retrieve, modify, and cancel a [flight plan](#) operating under Instrument Flight Rules (IFR).

This WSDD has been prepared in accordance with FAA-STD-065A, Department of Transportation Federal Aviation Administration, Preparation of Web Service Description Documents [\[3\]](#).

1.1 Background

In today's [NAS](#) environment, a [flight plan](#) specifies information that describes a desired route of flight between a well-defined departure and destination point within which separation services are required. Additional information provided in the flight plan shows that the flight meets the legal requirements of Instrument Flight Rules (IFR).

The intended outcome of [filing](#) an IFR flight plan is to receive air traffic control (ATC) separation services between the departure and destination airports through a subsequent flight plan clearance.

As a part of transitioning toward the Next Generation Air Transportation System (NextGen), the En Route Services Modernization Group (ESMG) has implemented this flight plan filing capability as a service designed in accordance with the principal of [Representational State Transfer \(REST\)](#). See the FPS Web Service Requirements Document [\[2\]](#) for more information.

Figure 1-1 depicts the architecture of FPS.

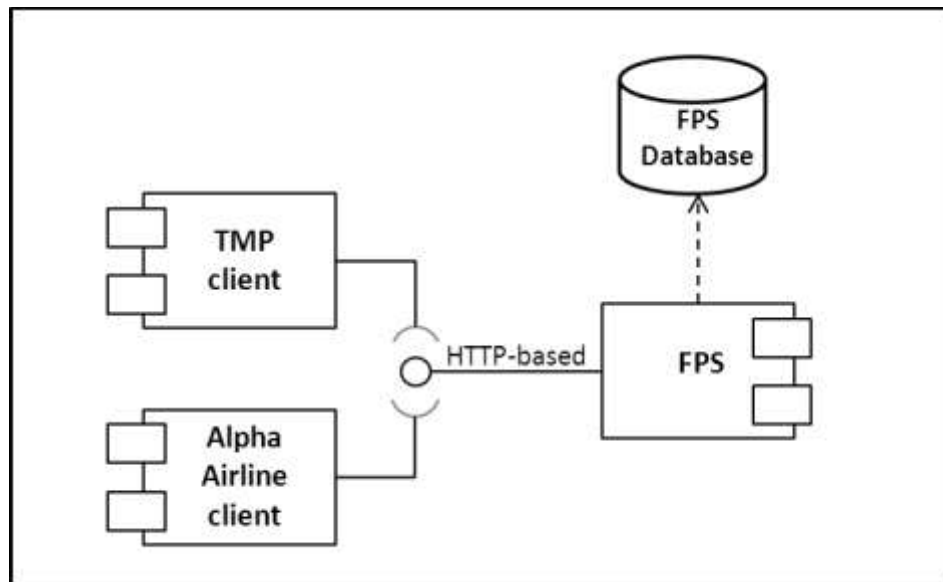


Figure 1-1 Architecture of FPS Environment

2 Applicable Documents

NOTE: Documents [5] and [6] do not actually exist.

2.1 Government Documents

- [1] FAA Order 1370.92A, Password and [PIN](#) Management Policy, 6 August 2010, <http://www.faa.gov/documentLibrary/media/Order/1370.92A.pdf>
- [2] FAA-1-234, Flight Plan Service (FPS) Web Service Requirements Document (WSRD), FAA, 13 July 2012, http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/techops/atc_comms_services/swim/governance/standards/
- [3] FAA-STD-065A, Preparation of Web Service Description Documents, FAA, 1 July 2013, http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/techops/atc_comms_services/swim/governance/standards/
- [4] FAA-STD-070, Preparation of Web Service Requirements Documents, FAA, 12 July 2012, http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/techops/atc_comms_services/swim/governance/standards/
- [5] Flight Plan Exchange Model (FPXM) Version 1.0, FAA, 10 January 2006, <http://faa.gov/fpxm/2006/>
- [6] Flight Plan Service (FPS) Policy Document Version 1, FAA, 4 June 2013, <https://www.faa.gov/atm/policies/fps-policy.xml>
- [7] NIST [FIPS](#) Publication 200, Minimum Security Requirements for Federal Information and Information Systems, March 2006, <http://csrc.nist.gov/publications/fips/fips200/FIPS-200-final-march.pdf>
- [8] NIST Special Publication 800-95, Guide to Secure Web Services, National Institute of Standards and Technology, August 2007, <http://csrc.nist.gov/publications/nistpubs/800-95/SP800-95.pdf>
- [9] Federal Aviation Administration Pilot/Controller Glossary (P/CG), Effective 3/7/12, http://www.faa.gov/air_traffic/publications/atpubs/pcg/index.htm

2.2 Non-Government Standards and Other Publications

- [10] ANSI/[INCITS](#) 359-2004, American National Standard for Information Technology - Role Based Access Control, Information Technology Industry Council, 3 February 2004, <http://www.cs.purdue.edu/homes/ninghui/readings/AccessControl/ANSI+INCITS+359-2004.pdf>
- [11] Extensible Markup Language (XML) 1.0 (Fifth Edition), [W3C](#) Recommendation 26 November 2008, <http://www.w3.org/TR/2008/REC-xml-20081126/>

- [12] [RFC](#) 2616, Hypertext Transport Protocol – HTTP/1.1, Network Working Group, June 1999, <http://www.w3.org/Protocols/rfc2616/rfc2616.html>
- [13] [RFC](#) 5246, The Transport Layer Security (TLS) Protocol Version 1.2, Network Working Group, August 2008, <http://tools.ietf.org/html/rfc5246>
- [14] Architectural Styles and the Design of Network-based Software Architectures, Roy Thomas Fielding, University of California, 2000, <http://www.ics.uci.edu/~fielding/pubs/dissertation/top.htm>
- [15] Web Services Description Language (WSDL) Version 2.0 Part 1: Core Language, [W3C](#) Recommendation 26 June 2007, <http://www.w3.org/TR/wsdl20>
- [16] RFC 2617 "HTTP Authentication: Basic and Digest Access Authentication", Network Working Group, June 1999, <http://tools.ietf.org/html/rfc2617>
- [17] [XML](#) Signature Syntax and Processing (Second Edition), [W3C](#) Recommendation, 10 June 2008, <http://www.w3.org/TR/xmlsig-core>
- [18] Web Application Description Language, W3C Member Submission 31 August 2009, <http://www.w3.org/TR/wsdl20/>

3 Definitions

3.1 Terms and Definitions

<i>Access Control</i>	Protection of system resources against unauthorized access; a process by which use of system resources is regulated according to a security policy and is permitted by only authorized entities. [4]
<i>Audit</i>	A process that records information needed to establish accountability for system events and for the actions of system entities that cause them. [3]
<i>Audit Trail</i>	A chronological record of system activities that is sufficient to enable the reconstruction and examination of the sequence of environments and activities. [4]
<i>Authentication</i>	The process of verifying an identity claimed by or for a system entity. [3]
<i>Authorization</i>	The granting of rights or permission to a system entity (mainly but not always a user or a group of users) to access a service . [3]
<i>Binding</i>	An association between an interface , a concrete protocol , and a data format . A binding specifies the protocol and data format to be used in transmitting messages defined by the associated interface. [3]
<i>Business Function</i>	A characteristic action or activity that needs to be performed to achieve a desired objective, or in the context of this WSDD , to achieve a real world effect . [3]
<i>Credentials</i>	Data that is transferred to establish the claimed identity of an entity. [4]
<i>Data Element</i>	A unit of data for which the definition, identification, representation, and permissible values are specified by means of a set of attributes. [3]
<i>Datatype</i>	A set of distinct values, characterized by properties of those values, and by operations on those values. [3]
<i>Effect</i>	A state or condition that results from interaction with a service . Multiple states may result depending on the extent to which the interaction completes successfully or generates a fault . [3]

FAA Telecommunications Infrastructure (FTI)	A network that supports National Airspace System (NAS) operations by providing the connectivity required by systems including the Enhanced Traffic Management Systems (ETMS), the Standard Terminal Automated Replacement System (STARS), and the Wide Area Augmentation System (WAAS), and applications like e-mail, Internet, payroll, and other administrative services. (Adapted from http://www.faa.gov/air_traffic/technology/fti/)
Fault	A message that is returned as a result of an error that prevents a service from implementing a required function. A fault usually contains information about the cause of the error. [3]
Flight Plan	Specified information relating to the intended flight of an aircraft that is filed orally or in writing with an FSS or an ATC facility. [9]
Filed	Used in conjunction with flight plans , meaning a flight plan has been submitted to ATC . [9]
Format	The arrangement of bits or characters within a group, such as a data element , message , or language. [3]
Idempotent	A term used to describe an operation in which a given message will have the same effect whether it is received once or multiple times; i.e., receiving duplicates of a given message will not cause any undesirable effect. [3]
Input	Data entered into, or the process of entering data into, an information processing system or any of its parts for storage or processing . [3]
HTTP Request	An HTTP request message , as defined in RFC 2616 Section 5. [12]
HTTP Response	An HTTP response message , as defined in RFC 2616 Section 6. [12]
Integrity	Protective measures that assure that data has not been changed, destroyed, or lost in an unauthorized or accidental manner. [3]
Method	An HTTP verb (e.g., GET, POST, PUT, DELETE), used in an HTTP Request message, that indicates a desired action to be performed on the resource identified in that message. (Adapted from [12])
Message	The basic unit of HTTP communication, consisting of a structured sequence of octets matching the syntax defined in section 4 of RFC 2616. [12]

Message Exchange Pattern (MEP)	A template, devoid of application semantics, that describes a generic pattern for the exchange of messages between agents . It describes the relationships (e.g., temporal, causal, sequential, etc.) of multiple messages exchanged in conformance with the pattern, as well as the normal and abnormal termination of any message exchange conforming to the pattern. [3]
Metadata	Data that defines or describes other data. [3]
Namespace	A collection of names, identified by a URI reference, that are used in XML documents as element types and attribute names. The use of XML namespaces to uniquely identify metadata terms allows those terms to be unambiguously used across applications, promoting the possibility of shared semantics. [3]
Non-Repudiation	Protective measures against false denial of involvement in a communication. [3]
Operation	A set of messages related to a single service action. [3] In the context of this document, the set consists of the HTTP request and HTTP response messages related to a single service action to be performed on the resource identified in the request message.
Output	Data transferred out of, or the process by which an information processing system or any of its parts transfers data out of, that system or part. [3]
Payload	The actual (business) data transferred by a message.
Permissible Values	The set of allowable instances of a data element . [3]
Precondition	A state or condition that is required to be true before an action can be successfully invoked. [3]
Processing	A set of algorithms, calculations, or business rules that operate on input data in order to produce the required output or to produce a change of internal state. [3]
Representational State Transfer (REST)	An architectural style that abstracts the architectural elements within a distributed hypermedia system. [14]
Resource	An object of information that is available on an Internet and identified by a unique URI . [4]
Role	A collection of permissions to use resources made available by a service . [4]

<i>Role-Based Access Control (RBAC)</i>	A form of identity-based access control where the system entities that are identified and controlled are functional positions in an organization or process. [4]
<i>Security</i>	The protection of information and data so that unauthorized persons or systems cannot read or modify them and authorized persons or systems are not denied access to them. [3]
<i>Synchronous Operation</i>	A type of operation whose message exchange pattern describes temporally coupled or "lock-step" interactions, e.g., remote procedure call (RPC)-style request-response interactions. [3]
<i>User</i>	A human, his/her agent , a surrogate, or an entity that interacts with information processing systems. A person, organization entity, or automated process that accesses a system, whether authorized to do so or not. [3]

3.2 Acronyms and Abbreviations

<i>AIXM</i>	Aeronautical Information Exchange Model
<i>ANSI</i>	American National Standards Institute
<i>ATC</i>	Air Traffic Control
<i>ATS</i>	Air Traffic Services
<i>ESB</i>	Enterprise Service Bus
<i>ESMG</i>	FAA En Route Services Modernization Group
<i>FAA</i>	Federal Aviation Administration
<i>FIXM</i>	Flight Information Exchange Model
<i>FIPS</i>	Federal Information Processing Standards
<i>FPS</i>	Flight Plan Service
<i>FPXM</i>	Flight Plan Exchange Model
<i>FSS</i>	Flight Service Station
<i>FTI</i>	FAA Telecommunications Infrastructure
<i>hPa</i>	hectopascal
<i>HTTP</i>	Hypertext Transport Protocol

ICAO	International Civil Aviation Organization
ID	Identifier
IFR	Instrument Flight Rules
INCITS	InterNational Committee for Information Technology Standards
MEP	Message Exchange Pattern
MSL	Mean Sea Level
NAS	National Airspace System
NEMS	NAS Enterprise Messaging Service
NextGen	Next Generation Air Transportation System
NIST	National Institute of Standards and Technology
OASIS	Organization for the Advancement of Structured Information Standards
P/CG	Pilot/Controller Glossary
PIN	Personal Identification Number
QoS	Quality of Service
RBAC	Role-Based Access Control
REST	Representational State Transfer
RFC	Request For Comments
RPC	Remote Procedure Call
TLS	Transport Layer Security
TMP	Traffic Modernization Program
URI	Uniform Resource Identifier
URL	Uniform Resource Locator
UTC	Coordinated Universal Time
VFR	Visual Flight Rules
W3C	World Wide Web Consortium
WADL	Web Application Description Language
WSDD	Web Service Description Document
WSDL	Web Services Description Language

<i>WSRD</i>	Web Service Requirements Document
<i>WSS</i>	Web Service Security
<i>XML</i>	eXtensible Mark-up Language

4 Service Profile

Name:	Flight Plan Service (FPS)
Namespace:	urn:us:gov:dot:faa:example:atm:enroute:fps
Description:	Service for retrieving, filing , deleting, and modifying an IFR flight plan for subsequent automatic submission to FAA flight data processing
Revision:	A
Service Category:	Air Traffic Control Information Service [urn:us:gov:dot:faa:taxonomies:service-category#1.3.1.3] Flight Information Service [urn:us:gov:dot:faa:taxonomies:service-category#1.3.1.3.2]
Lifecycle Stage	Development [urn:us:gov:dot:faa:taxonomies:lifecycle-stage#development]
Criticality Level:	Essential [urn:us:gov:dot:faa:taxonomies:service-criticality#essential]

4.1 Service Provider

Name:	FAA En Route Services Modernization Group (ESMG)
Description:	A program within the FAA Air Traffic Organization responsible for developing SOA -based services
Namespace:	urn:us:gov:dot:faa:example:atm
Web Page:	http://www.faa.gov/air_traffic/flight_info/

4.1.1 Point of Contact

Name	John D. Doe
Title	ATO-X ESGM Manager
Telephone	(609) 444-5555
E-mail Address	Joe.doe@faa.gov
Postal Address	Bldg. 300 FAA William J. Hughes Technical Center Atlantic City International Airport Atlantic City, NJ

4.2 Service Consumers

4.2.1 Traffic Modernization Program (TMP)

Name: FAA Traffic Modernization Program (TMP)

Description: The FAA-maintained program responsible for regulating traffic during arrival, departure, or approach stages of flights with the goal to avoid exceeding airport or air traffic control capacity.

Web Page: http://www.faa.gov/air_traffic/TMP/ *

4.2.2 Alpha Airline

Name: Alpha Airline

Description: A United States commercial air carrier headquartered in Atlanta, Georgia. Alpha Airline provides air transport services for passengers and freight.

Web Page: <http://www.example.alpha.com> *

* The URLs in section 4.2 are provided as examples only and do not resolve to any [resource](#).

4.3 Service Functionality

Table 4-1 describes the [business functions](#) of the FPS in terms of the [real world effects](#) that result from invoking these functions.

Table 4-1 FPS Business Functions

Business Function	Real World Effect
Retrieve an existing (filed) flight plan .	A filed flight plan has been retrieved.
File a flight plan.	A flight plan has been filed and persists in the FAA Web server for distribution to the FAA flight data processing application within some parameter time of the estimated departure time.
Change destination aerodrome of a flight plan.	The destination aerodrome of a filed flight plan has been changed.
Cancel a flight plan.	A previously filed flight plan has been retracted before being submitted to FAA ATS , thereby reducing the flight plan processing load and systemic workload of the FAA air traffic planning system.

4.4 Security

4.4.1 Security Policies

The FPS complies with [NIST](#) Special Publication 800-95, Guide to Secure Web Services, National Institute of Standards and Technology, August 2007, available at <http://csrc.nist.gov/publications/nistpubs/800-95/SP800-95.pdf> [8].

The FPS deploys Transport Layer Security (TLS) Protocol Version 1.2, [RFC](#) 5246, Network Working Group, August 2008, available at <http://tools.ietf.org/html/rfc5246> [13].

4.4.2 Security Mechanisms

FPS deploys the following [security](#) mechanisms: [authentication](#), [authorization](#), [integrity](#), [non-repudiation](#), and [audit](#). Each is described in a separate section below.

4.4.2.1 Authentication

The FPS requires each [service consumer](#) to [authenticate](#) itself to the FPS at the transport level by deploying HTTP Basic Access Authentication in accordance with the RFC 2617 "HTTP Authentication: Basic and Digest Access Authentication", Network Working Group, June 1999, available at <http://tools.ietf.org/html/rfc2617> [16].

The FPS complies with identification and authentication requirements set forth in [NIST FIPS](#) Publication 200, Minimum Security Requirements for Federal Information and Information Systems, March 2006, available at <http://csrc.nist.gov/publications/fips/fips200/FIPS-200-final-march.pdf> [7].

The FPS complies with FAA Order 1370.92A, Password and [PIN](#) Management Policy, 6 August 2010, available at <http://www.faa.gov/documentLibrary/media/Order/1370.92A.pdf> [1].

4.4.2.2 Authorization

The FPS uses the [credentials](#) received as part of the [authentication](#) process described above for future determinations of whether or not a [service consumer](#) is [authorized](#) to invoke an [operation](#) it may request.

The FPS deploys [role-based access control](#) (RBAC) for implementing authorization in accordance with [ANSI/INCITS](#) 359-2004, American National Standard for Information Technology - Role Based Access Control, Information Technology Industry Council, 3 February 2004, available at <http://www.cs.purdue.edu/homes/ninghui/readings/AccessControl/ANSI+INCITS+359-2004.pdf> [10]. Two [roles](#) are defined, "Reader" and "Originator". These are described in Table 4-2 and further depicted in Figure 4-1.

Table 4-2 FPS Roles

Name	Description
Reader	A user who only has permission to read or examine ('view only') a filed flight plan .

Name	Description
Originator	A user, generally a pilot or operator, who submits a flight plan and has permission to file and subsequently modify or cancel the filed flight plan. Since the Reader role is derived from the Originator role, an Originator role inherently includes the “view” privileges.

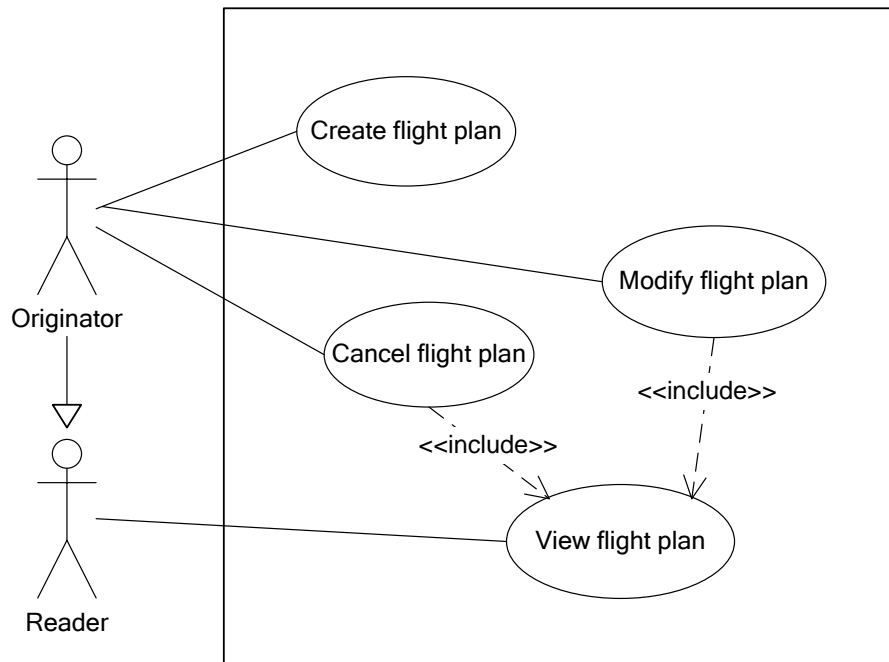


Figure 4-1 FPS Roles Use Case Diagram

4.4.2.3 Integrity

Because the FPS uses the [TLS protocol](#) cited in section 4.4.1 above, data is checked for possible corruption.

4.4.2.4 Non-repudiation

The FPS complies with XML Signature Syntax and Processing (Second Edition), W3C Recommendation, 10 June 2008, available at <http://www.w3.org/TR/xmlsig-core> [17] to ensure that each [user's message](#) is digitally signed.

4.4.2.5 Auditing

The FPS keeps an [audit trail](#) of all [service](#) requests. Each FPS service request is timestamped with the date and time the request was made. Each audit trail record includes [user ID](#) (using [credentials](#) received as part of the [authentication](#) process), date, time, [operation](#) requested, and an error description if the operation failed. Access to the audit trail is limited to users with system administrator privileges.

4.5 Qualities of Service

The [qualities of service \(QoS\)](#) that the FPS is expected to meet or possess are listed in Table 4-3.

Table 4-3 FPS Quality of Service Requirements

QoS Parameter Name	Value	Definition	Calculation Method	Unit of Measure
Availability	≥ 99.900	Probability that the service is present or ready for immediate use.	100 * ((24 – Total Outage Time) / 24). Measurements are taken daily and apply to the preceding 24-hour period.	Percentage, accurate to 3 decimal places
Capacity	20 per minute	Number of service requests that the service can accommodate within a given time period.	Simple count.	Whole positive number, per period of time.
Response Time	3	Maximum time required to complete a service request.	Measured from the time the service provider agent receives the request to the time the service provider transmits the response.	Seconds.

4.6 Service Policies

The policy document [\[6\]](#) associated with FPS can be found at:

<https://www.faa.gov/atm/policies/fps-policy.xml>. * Note: proper [authentication](#) may be required to access the document. For information about obtaining access to the policy document, contact the individual indicated in section 4.1.1 of this [WSDD](#).

* The [URL](#) does not resolve to any [resource](#) and is provided as an example only.

4.7 Environmental Constraints

The FPS operates within the [FAA Telecommunications Infrastructure](#) (FTI) and is subject to its performance constraints. It is also available over the public Internet.

5 Service Interface

5.1 Interfaces

By virtue of being a [service](#) built using the [REST](#) architectural approach, the FPS exposes a uniform [HTTP](#) interface, i.e., it uses a fixed and generic set of HTTP [methods](#). To make the interface description explicit and associate implemented methods with the business functions (section 4.1 above), this WSDD creates logical names that uniquely identify all operations and can be used in machine-processable artifacts (see [Appendixes D](#) and [E](#)).

Table 5-1 FPS Interface Description

Name	Description	Operations
FlightPlanInterface	FlightPlanInterface allows a user to file a flight plan and subsequently retrieve , modify or cancel a flight plan.	FileFlightPlan RetrieveFlightPlan UpdateDestinationAerodrome CancelFlightPlan

5.2 Operations

[Messages](#) exchanged during execution of the [operations](#) are described in section 5.3 of the [WSDD](#). [Faults](#) generated as a result of operation failure are described in section 5.4 of the [WSDD](#).

5.2.1 FileFlightPlan

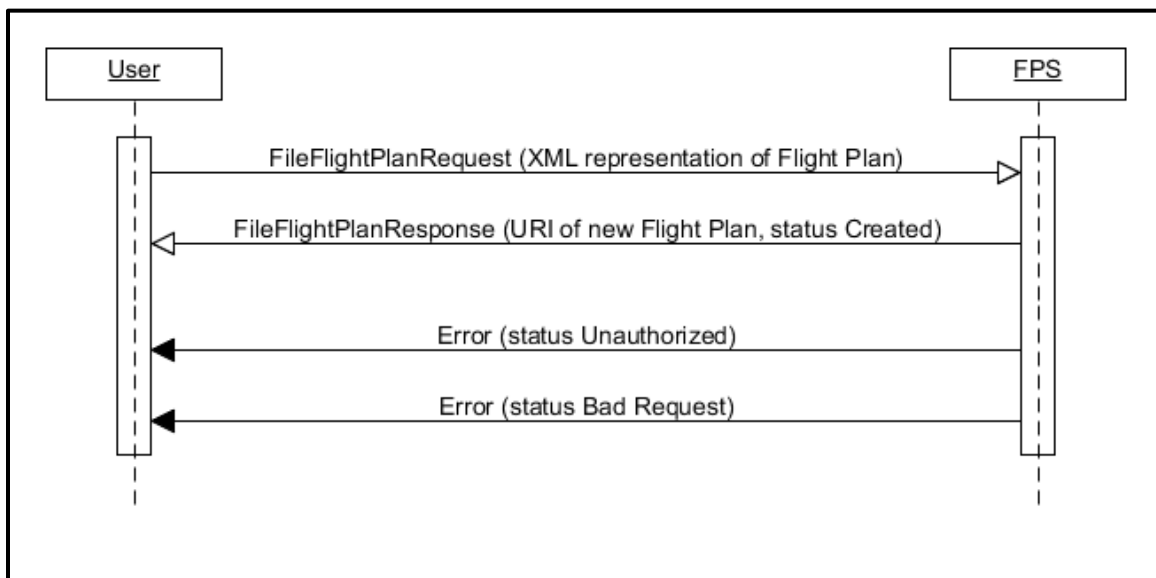


Figure 5-1 Operation FileFlightPlan Sequence Diagram

Table 5-2 Operation FileFlightPlan

Name	FileFlightPlan
Description	The FileFlightPlan operation uses the HTTP POST method to allow a user to create (file) a flight plan . Upon acceptance, the service subsequently stores the flight plan in the FPS data server.
MEP	In-Out
Operation Type	Synchronous
Idempotency	Non-Idempotent
Precondition	Service consumer has been authenticated and authorized to perform the FileFlightPlan operation.
Input	Message FileFlightPlanRequest containing XML representation of flight plan to be filed.
Output	Message FileFlightPlanResponse containing the URI for newly created flight plan resource along with status indicating that request has been fulfilled.
Effect	Flight plan has been accepted and stored (filed) in the FPS data server.
Faults	Unauthorized Bad Request

5.2.1.1 Example of Code

A part of the posted data is shown here. For a complete example of an XML representation of a [flight plan](#), see [Appendix C](#).

```
# Request
POST /fps/flight-plan HTTP/1.1
Host: faa.gov.example
Content-Type: application/xml; charset=UTF-8

<FlightPlan flightRule="I"
    numberOfAircraft="1"
    filingTime="2001-12-17T09:30:47Z" >
  <FlightPlanId xsi:nil="true" />
</FlightPlan>

# Response
HTTP/1.1 201 Created
Location: http://faa.gov/fps/flight-plan/7835
Content-Location: http://faa.gov/fps/flight-plan/7835
```


5.2.2 RetrieveFlightPlan

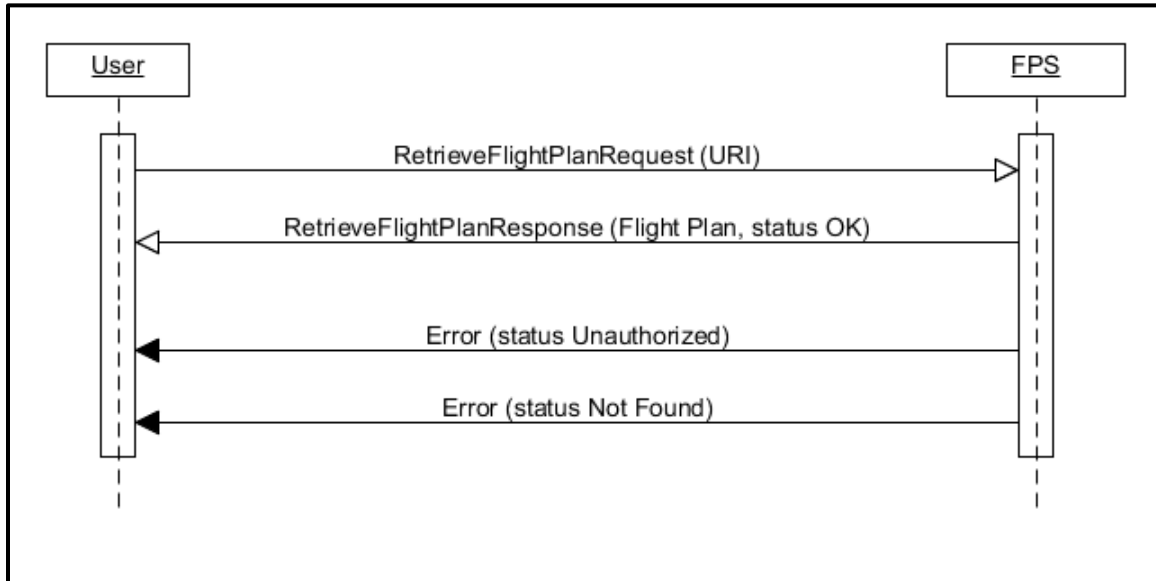


Figure 5-2 Operation RetrieveFlightPlan Sequence Diagram

Table 5-3 Operation RetrieveFlightPlan

Name	RetrieveFlightPlan
Description	The RetrieveFlightPlan operation uses the HTTP GET method to allow a user to retrieve a previously filed flight plan .
MEP	In-Out
Operation Type	Synchronous
Idempotency	Non-Idempotent
Precondition	Service consumer has been authenticated and authorized to perform the RetrieveFlightPlan operation. The referenced flight plan has been filed.
Input	Message RetrieveFlightPlanRequest containing the URI that references identified flight plan resource .
Output	Message RetrieveFlightPlanResponse containing XML representation of flight plan and status indicating successful completion of request.
Effect	Flight plan has been retrieved for presentation.
Faults	Unauthorized Not Found

5.2.2.1 Example of Code

A part of the retrieved data is shown here. For a complete example of an XML representation of a [flight plan](#), see [Appendix C](#).

```
# Request
GET /fps/flight-plan/7835 HTTP/1.1
Host: faa.gov.example
Content-Type: application/xml; charset=UTF-8

# Response
HTTP/1.1 200 OK
Content-Type: application/xml; charset=UTF-8
Content-Length: 1416
# XML document returned in response
<FlightPlan flightRule="I"
    numberOfAircraft="1"
    filingTime="2001-12-17T09:30:47Z" >
    <FlightPlanId="7835" />
    ...
</FlightPlan>
```

5.2.3 UpdateDestinationAerodrome

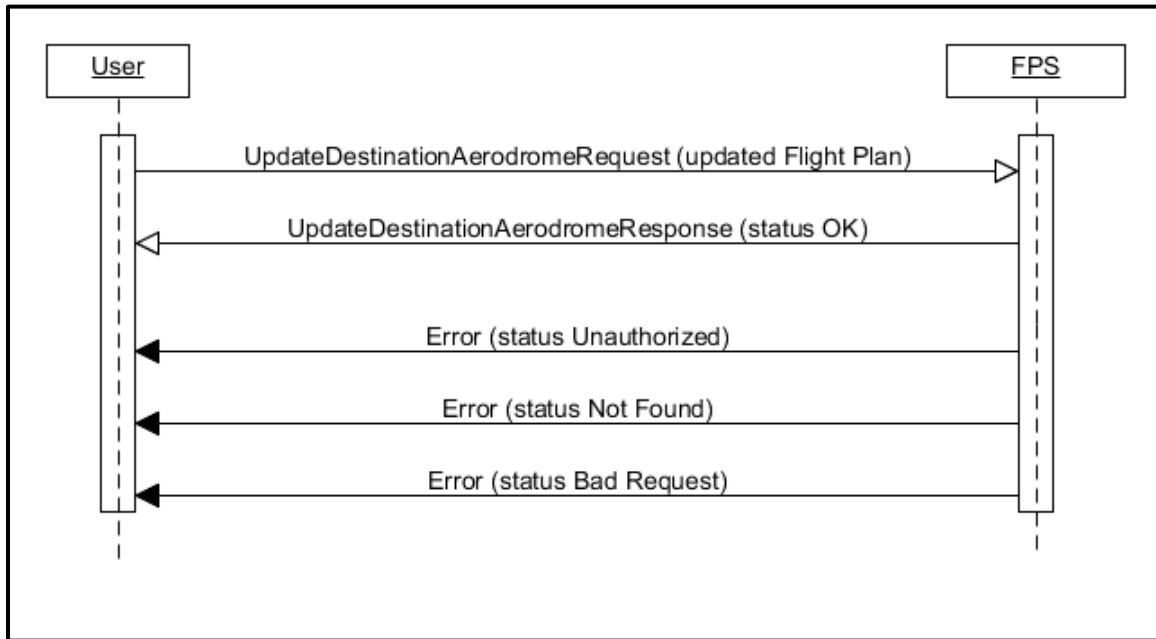


Figure 5-3 Operation UpdateDestinationAerodrome Sequence Diagram

Table 5-4 Operation UpdateDestinationAerodrome

Name	UpdateDestinationAerodrome
Description	The UpdateDestinationAerodrome operation uses the HTTP PUT method to allow a user to update the destination aerodrome information in the filed flight plan .
MEP	In-Out
Operation Type	Synchronous
Idempotency	Non-Idempotent
Precondition	Service consumer has been authenticated and authorized to update flight plan information. The referenced flight plan has been filed.
Input	Message UpdateDestinationAerodromeRequest containing XML representation of flight plan with the new destination aerodrome.
Output	Message UpdateDestinationAerodromeResponse containing status indicating successful completion of request.
Effect	Originally indicated flight destination aerodrome has been changed.

Faults	Unauthorized Not Found Bad Request
---------------	--

5.2.3.1 Example of Code

A part of the posted data is shown here. For a complete example of an XML representation of a [flight plan](#), see [Appendix C](#).

```
# Request
PUT /fps/flight-plan/7835 HTTP/1.1
Host: faa.gov.example
Content-Type: application/xml; charset=UTF-8

<FlightPlan xmlns="urn:us:gov:dot:faa:example:atm:enroute:fps:entities"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="./FlightPlan.xsd"
  flightRule="I"
  numberOfAircraft="1"
  filingTime="2001-12-17T09:30:47Z" >
  <FlightPlanId="7835" />
  ...
  <DestinationAerodrome aerodromeId="KBOS">
    <Name> Manchester-Boston Regional Airport, Boston, MA</Name>
  </DestinationAerodrome>
  ...
</FlightPlan>

# Response
HTTP/1.1 200 OK
Content-Type: application/xml; charset=UTF-8
Content-Length: 1416
```

5.2.4 CancelFlightPlan

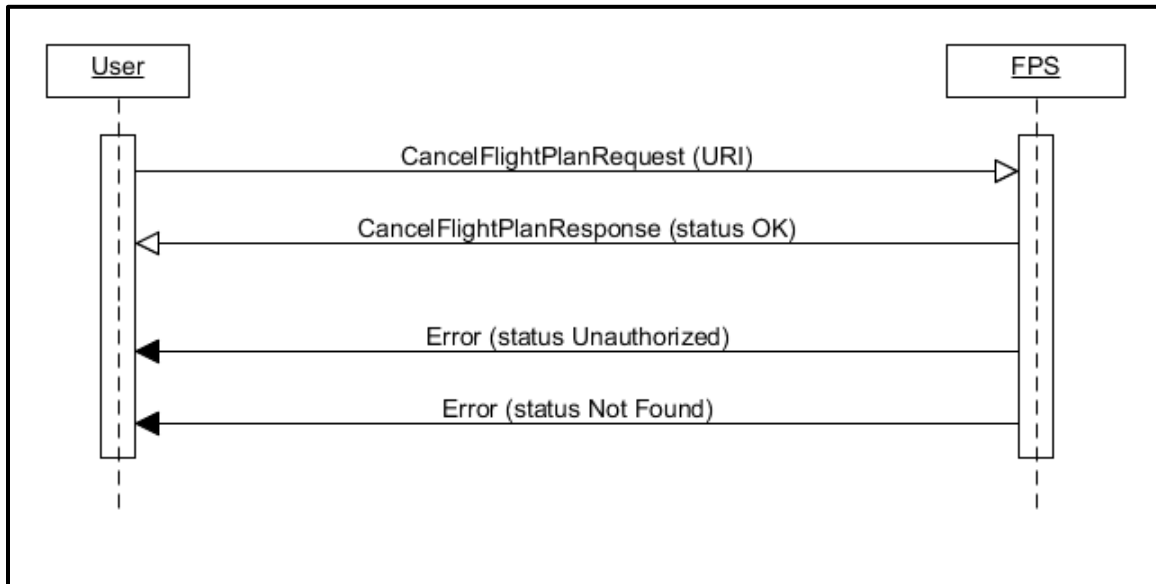


Figure 5-4 Operation CancelFlightPlan Sequence Diagram

Table 5-5 Operation CancelFlightPlan

Name	CancelFlightPlan
Description	The CancelFlightPlan operation uses the HTTP DELETE method to allow a user to cancel (logically delete) a previously filed flight plan .
MEP	In-Out
Operation Type	Synchronous
Idempotency	Non-Idempotent
Precondition	Service consumer has been authenticated and authorized to perform the CancelFlightPlan operation. The referenced flight plan has been filed.
Input	Message CancelFlightPlanRequest containing the URI that references identified flight plan resource .
Output	Message CancelFlightPlanResponse containing confirmation of canceling the flight plan.
Effect	Flight plan has been canceled, that is, logically deleted from the FPS data server.
Faults	Unauthorized Not Found

5.2.4.1 Example of Code

```
# Request
DELETE /fps/flight-plan/7835 HTTP/1.1
Host: faa.gov.example
Content-Type: application/xml;charset=UTF-8

# Response
HTTP/1.1 200 OK
```

5.3 Messages

This section lists all [messages](#) used by [operations](#) described in section 5.2. All messages listed in this section are instances of HTTP Messages, that is, they are fully compliant with RFC 2616 Section 4. [\[12\]](#)

Note: in the syntax used to represent a [URI](#) instance, values in italics and in curly brackets indicate data types and not literal values.

5.3.1 FileFlightPlanRequest

Name	FileFlightPlanRequest
Description	An instance of HTTP Request that passes a flight plan to be filed .
Direction	Input
Payload	XML representation of FlightPlan resource (see Appendix C for complete version of the message payload).

5.3.2 FileFlightPlanResponse

Name	FileFlightPlanResponse
Description	An instance of HTTP Response containing the information that flight plan has been accepted and filed (stored) along with a location of newly filed flight plan resource .
Direction	Output
Payload	URI of the resource that represents newly filed flight plan: <code>http://faa.gov/fps/flight-plan/{<i>FlightPlanId</i>}</code> HTTP Status Code "201 Created" indicating that request has been completed successfully. HTTP Status Code "400 Bad Request" and/or "401 Unauthorized" when operation has failed. See section 5.4 Faults for details.

5.3.3 RetrieveFlightPlanRequest

Name	RetrieveFlightPlanRequest
Description	An instance of HTTP Request that passes the reference to the flight plan to be retrieved.
Direction	Input
Payload	URI of the resource (flight plan) to be retrieved: http://faa.gov/fps/flight-plan/{FlightPlanId}

5.3.4 RetrieveFlightPlanResponse

Name	RetrieveFlightPlanResponse
Description	An instance of HTTP Response containing XML representation of requested flight plan.
Direction	Output
Payload	<p>XML representation of FlightPlan resource (see Appendix C for complete version of the message payload).</p> <p>HTTP Status Code "201 Created" indicating that request has been completed successfully.</p> <p>HTTP Status Code "404 Not Found" and/or "401 Unauthorized" when operation has failed. See section 5.4 Faults for details.</p>

5.3.5 UpdateDestinationAerodromeRequest

Name	UpdateDestinationAerodromeRequest
Description	An instance of HTTP Request that passes the flight plan within which the destination aerodrome has been changed.
Direction	Input
Payload	XML instance of FlightPlan element with DestinationAerodrome element modified. (see Appendix C for complete version of the message payload).

5.3.6 UpdateDestinationAerodromeResponse

Name	UpdateDestinationAerodromeResponse
Description	An instance of HTTP Response containing the information that flight plan has been updated.
Direction	Output
Payload	<p>HTTP Status Code "200 OK" indicating that request has been completed successfully and flight plan has been updated.</p> <p>HTTP Status Code "400 Bad Request" and/or "401 Unauthorized" and/or "404 Not Found" when operation has failed. See section 5.4 Faults for details.</p>

5.3.7 CancelFlightPlanRequest

Name	CancelFlightPlanRequest
Description	An instance of HTTP Request that passes the reference to the flight plan to be canceled.
Direction	Input
Payload	URI of the resource (flight plan) to be canceled: <code>http://faa.gov/fps/flight-plan/{FlightPlanId}</code>

5.3.8 CancelFlightPlanResponse

Name	UpdateDestinationAerodromeResponse
Description	An instance of HTTP Response containing the information that flight plan has been canceled.
Direction	Output
Payload	<p>HTTP Status Code "200 OK" indicating that request has been completed successfully and flight plan has been updated.</p> <p>HTTP Status Code "400 Bad Request" and/or "401 Unauthorized" and/or "404 Not Found" when operation has failed. See section 5.4 Faults for details.</p>

5.4 Faults

Table 5-6 FPS Fault Messages

ID	Name	Description	Data Elements
400	Bad Request	The request is malformed; it does not pass validation and cannot be understood by the service .	NA
401	Unauthorized	The user has not been properly authenticated and/or authorized to perform requested operation.	N/A
404	Not Found	The requested resource (flight plan) has not been found.	N/A

5.5 Data Elements

NOTE: Section 5.9.5 requirement (u) of FAA-STD-065A [3] states that a conceptual data model of all data used by the [service](#) shall be included in this section of the [WSDD](#). A data model is usually the result of an architectural effort, and a reference to the model's location in the architecture can be made instead of reproducing the model in the WSDD.

In this WSDD example, we have simulated a scenario in which a data model has been developed as a separate effort. Because the example is unable to supply a real [URL](#) for the model, a conceptual model of the data elements that appear in the FlightPlan [XML](#) schema is provided in Figure 5-5, and the XML schema itself is provided in [Appendix A](#) (a diagram of the schema appears in [Appendix B](#).) An example of an instantiation of this schema is provided in [Appendix C](#).

Note also that the [WADL](#) and [WSDL](#) documents in [Appendixes D](#) and [E](#) respectively refer to the same XML schema.

All data exchanged by the FPS conforms to the FPXM 1.0, Flight Plan Exchange Model, 10 January 2006, available at <http://faa.gov/fpxm/2006/> * [5]. A conceptual data model (Figure 5-5) is available at http://faa.gov/fpxm/2006/FPXM_Conceptual_Model.pdf *.

All [data elements](#) provided by the FPS conform to definitions, syntax, and constraints as defined in the [XML](#) schema found at <http://faa.gov/fpxm/2006/fpxm10.xsd> *. (See [Appendix A](#) for a copy of the schema.)

Data elements are also described in Table 5-8 in accordance with FAA-STD-065A section 5.9.5 [3].

* The [URLs](#) in section 5.5 are provided as examples only and do not resolve to any [resource](#).

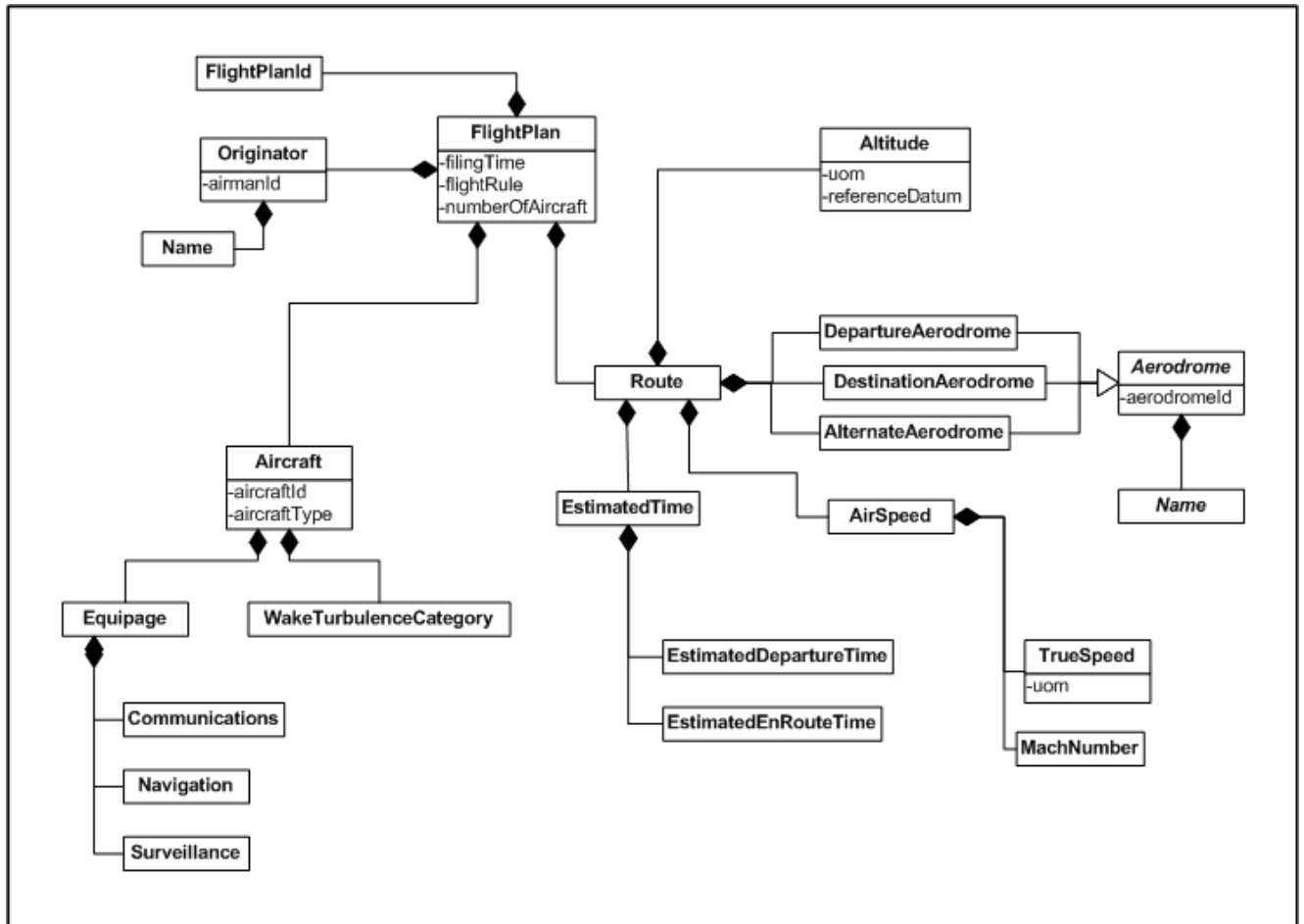


Figure 5-5 Flight Plan Exchange Conceptual Model

NOTE: Section 5.9.5 requirement (a) of FAA-STD-065A [3] states that section 5.5 of the [WSDD](#) shall list and describe all data elements, complex or primitive, that appear in messages (or faults) to be sent or received via the [service](#). The following table does not contain an exhaustive list of all of the data elements but rather provides a subset of elements selected to exemplify how data elements should be presented in a WSDD.

Note also that all [metadata](#) is required (Unit of Measure and Permissible Values are required if applicable) except for Maximum Length and Format which are optional.

All [data elements](#) in Table 5-8 are defined in the [namespace](#) <http://faa.gov/fpxm>

Table 5-7 Selected Flight Plan Data Elements

Name	Definition	Permissible Values	Unit of Measure	Datatype	Format	Obligation	Occurrence
FlightPlan	The outmost container (root) element for all data provided by the pilot or his/her designated representative to air traffic services units, relative to the intended flight or portion of the flight of the aircraft.	N/A	N/A	Complex		Required	1
FlightPlanId	An element that uniquely identifies the flight plan .	N/A	N/A	String	[A-Za-z0-9]*	Required	1
FlightPlan.flightRule	A code representing regulations (i.e., instrument or visual flight rules) under which the pilot is flying or intends to fly the aircraft.	"I" – IFR only "V" – VFR only "Y" – IFR first "Z" – VFR first	N/A	String		Required	1

Name	Definition	Permissible Values	Unit of Measure	Datatype	Format	Obligation	Occurrence
FlightPlan.filingTime	The point in time (UTC) at which the flight plan is filed .	N/A	N/A	dateTime	CCYY-MM-DDThh:mm:ssZ	Required	1
Altitude	An element that indicates the pressure altitude above mean sea level (MSL) at which the aircraft is flying or is intended to be flown.	N/A	N/A	Complex		Required	1
Altitude.uom	A code representing the units of measure of the aircraft's altitude.	"m", "meter" – altitude in meters "foot" – altitude in feet	N/A	String		Required	1
Altitude.referenceDatum	A code representing the atmospheric pressure reference used to adjust a pressure altimeter.	"Local" – local pressure extrapolated to zero MSL . "Standard" – pressure with respect to the pressure datum 1013.2 hectopascals (hPa).	N/A	String		Required	1
Aircraft	A container element for all data related to the aircraft.	N/A	N/A	Complex		Required	1

Name	Definition	Permissible Values	Unit of Measure	Datatype	Format	Obligation	Occurrence
Aircraft.aircraftType	An aircraft type designator that informs an air traffic controller of the performance characteristics of the aircraft.	Values are listed in ICAO 8643 , Aircraft Type Designators, http://legacy.icao.int/anb/ais/8643/ .	N/A	String		Required	1
WakeTurbulenceCategory	A code that classifies the aircraft for the purpose of wake turbulence separation minima, based on the maximum certified takeoff mass of the aircraft.	<p>“H”, “HEAVY” – aircraft having a maximum certificated take-off mass of 136,000 kg (300,000 lb) or more.</p> <p>“M”, “MEDIUM” – aircraft having a maximum certificated take-off mass of less than 136,000 kg (300,000 lb) and more than 7,000 kg (15,500 lb).</p> <p>“L”, “LIGHT” – aircraft having a maximum certificated take-off mass of 7,000 kg (15,500 lb) or less.</p>	N/A	String		Required	1

Name	Definition	Permissible Values	Unit of Measure	Datatype	Format	Obligation	Occurrence
DestinationAerodrome	A container element for all data related to the primary aerodrome to which the flight is destined.	N/A	N/A	Complex		Required	1
DestinationAerodrome.aerodromeld	An element that uniquely identifies the destination aerodrome.	Values are listed in ICAO Document 7910, Location Indicators, http://store1.icao.int/mainpage.ch2 .	N/A	String	[A-Z][A-Z][A-Z][A-Z]	Required	1
DestinationAerodrome.Name	An element that contains the name or location (nearest city) of the destination aerodrome.	N/A	N/A	String		Optional	1

5.6 Machine-Processable Service Description Document

NOTE: This section provides a [WSDL](#) as well as a [WADL](#) document to make the WSDD example more complete and does not suggest that a WSDD for a [REST](#)ful service shall include both types of machine-processable service descriptions. The determination of which document(s) shall be used in the WSDD is usually made based on the governance policies to which the service is subjected.

Name	FlightPlanService.wadl
Standard	Web Application Description Language, W3C Member Submission 31 August 2009, http://www.w3.org/TR/wsd120/ [18]
Version	1.0
Location	1. http://faa.gov/example/FlightPlan/wadl/FlightPlanService.wadl * 2. Appendix D
Name	FlightPlanService.wsdl
Standard	Web Services Description Language (WSDL) Version 2.0 Part 1: Core Language, W3C Recommendation 26 June 2007, http://www.w3.org/TR/wsd120/ [15]
Version	1.0
Location	1. http://faa.gov/example/FlightPlan/wsdl/FlightPlanService.wsdl * 2. Appendix E

* The [URL](#) does not resolve to any [resource](#) and is provided as an example only.

6 Service Implementation

6.1 Bindings

6.1.1 Binding “RESTFlightPlanBinding”

The FPS deploys the [protocols](#) described in sections 6.1.1.1 through 6.1.1.3 for the [binding](#) to the [interface](#) “FlightPlanInterface”.

6.1.1.1 Data Protocol

For data serialization, the FPS uses Extensible Markup Language (XML) 1.0 (Fifth Edition), [W3C](#), November 2008, <http://www.w3.org/TR/2008/REC-xml-20081126/> [11].

6.1.1.2 Message Protocol

All [messages](#) exchanged by the FPS are constructed in accordance with HTTP/1.1, [RFC](#) 2616, Network Working Group, June 1999, <http://www.w3.org/Protocols/rfc2616/rfc2616.html> [12].

6.1.1.3 Transport Protocol

The FPS uses Hypertext Transport Protocol – HTTP/1.1, [RFC](#) 2616, Network Working Group, June 1999, <http://www.w3.org/Protocols/rfc2616/rfc2616.html> [12] as a transport-level protocol.

6.2 End Points

6.2.1 End Point “HTTPFlightPlanEndPoint”

Associated binding: [“RESTFlightPlanBinding”](#)

Network address: <http://esmg.faa.gov/dev/flight-plan/> *

* The [URL](#) does not resolve to any [resource](#) and is provided as an example only.

7 Appendixes

Appendix A. Schema of XML Representation – fpxm.xsd

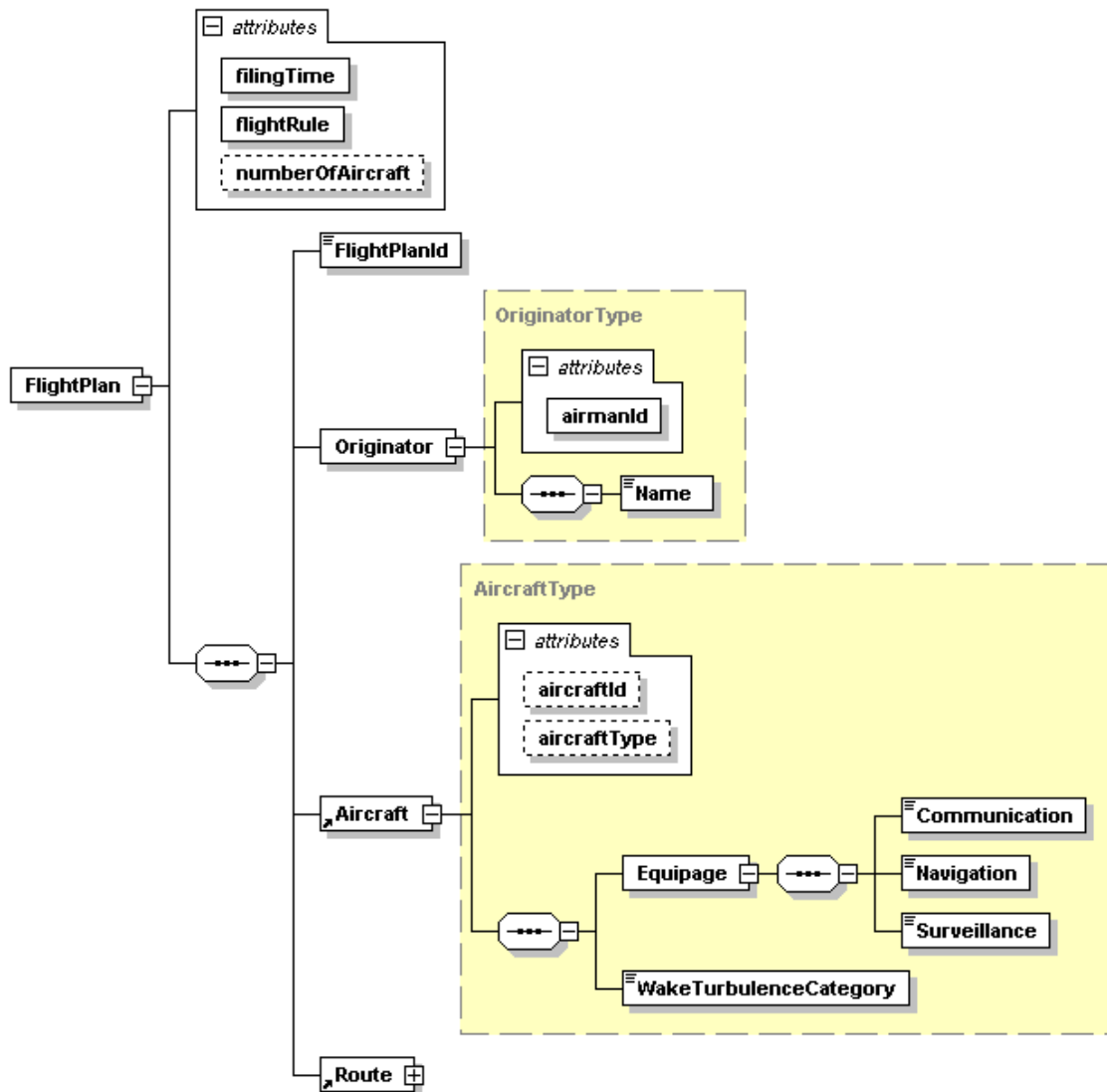
```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
  xmlns="http://faa.gov/fpxm"
  targetNamespace="http://faa.gov/fpxm"
  elementFormDefault="qualified" attributeFormDefault="unqualified">
  <xs:annotation>
    <xs:documentation xml:lang="en">
      Title: FlightPlan schema for WSDD Example.
      Description: This schema declares XML elements for defining
        a Flight Plan transmitted by FlightPlanService
      Creator: Mark Kaplun (mark.kaplun@faa.gov)
      Date: 2010-01-21
    </xs:documentation>
  </xs:annotation>
  <!-- ////////// Global types ////////// -->
  <xs:element name="FlightPlan">
    <xs:complexType>
      <xs:sequence>
        <!-- "FlightPlanId" is always required.
          When flight plan is filed and the "FlightPlanId" element has no content
          - the content is nil. -->
        <xs:element name="FlightPlanId" type="FlightPlanIdType" nillable="true"/>
        <xs:element name="Originator" type="OriginatorType"/>
        <xs:element ref="Aircraft"/>
        <xs:element ref="Route"/>
      </xs:sequence>
      <xs:attribute name="filingTime" type="xs:dateTime" use="required"/>
      <xs:attribute name="flightRule" type="FlightRuleType" use="required"/>
      <xs:attribute name="numberOfAircraft" type="xs:positiveInteger" default="1"/>
    </xs:complexType>
  </xs:element>
  <xs:element name="Aircraft" type="AircraftType"/>
  <xs:element name="Route" type="RouteType"/>
  <!-- ////////// Types definitions ////////// -->
  <xs:simpleType name="FlightPlanIdType">
    <xs:restriction base="xs:string">
      <xs:pattern value="[A-Za-z0-9]*"/>
    </xs:restriction>
  </xs:simpleType>
  <xs:complexType name="AircraftType">
```

```
<xs:sequence>
  <xs:element name="Equipage">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="Communication" type="xs:string"/>
        <xs:element name="Navigation" type="xs:string"/>
        <xs:element name="Surveillance" type="xs:string"/>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
  <xs:element name="WakeTurbulenceCategory" type="WakeTurbulenceCategoryType"/>
</xs:sequence>
<xs:attribute name="aircraftId" type="xs:string"/>
<xs:attribute name="aircraftType" type="xs:string"/>
<!-- Values are listed in ICAO 8643, Aircraft Type Designators,
      http://www.icao.int/anb/ais/8643/index.cfm.-->
</xs:complexType>
<xs:complexType name="OriginatorType">
  <xs:sequence>
    <xs:element name="Name" type="xs:string"/>
  </xs:sequence>
  <xs:attribute name="airmanId" type="xs:string" use="required"/>
</xs:complexType>
<xs:complexType name="RouteType">
  <xs:sequence>
    <xs:element name="Altitude" type="AltitudeType"/>
    <xs:element name="EstimatedTime ">
      <xs:complexType>
        <xs:sequence>
          <xs:element name="EstimatedDepartureTime" type="xs:time"/>
          <xs:element name="EstimatedEnRouteTime" type="xs:duration"/>
        </xs:sequence>
      </xs:complexType>
    </xs:element>
    <xs:element name="AirSpeed" type="AirSpeedType"/>
    <xs:element name="DepartureAerodrome" type="AerodromeType"/>
    <xs:element name="DestinationAerodrome" type="AerodromeType"/>
    <xs:element name="AlternateAerodrome" type="AerodromeType"/>
    <xs:any minOccurs="0" maxOccurs="unbounded">
      <!--This element is declared as "any" to indicate that Route element
            can be extended with elements such as: fixes (significant points),
            route names, route segments and etc. -->
    </xs:any>
  </xs:sequence>
</xs:complexType>
<xs:complexType name="AerodromeType">
```

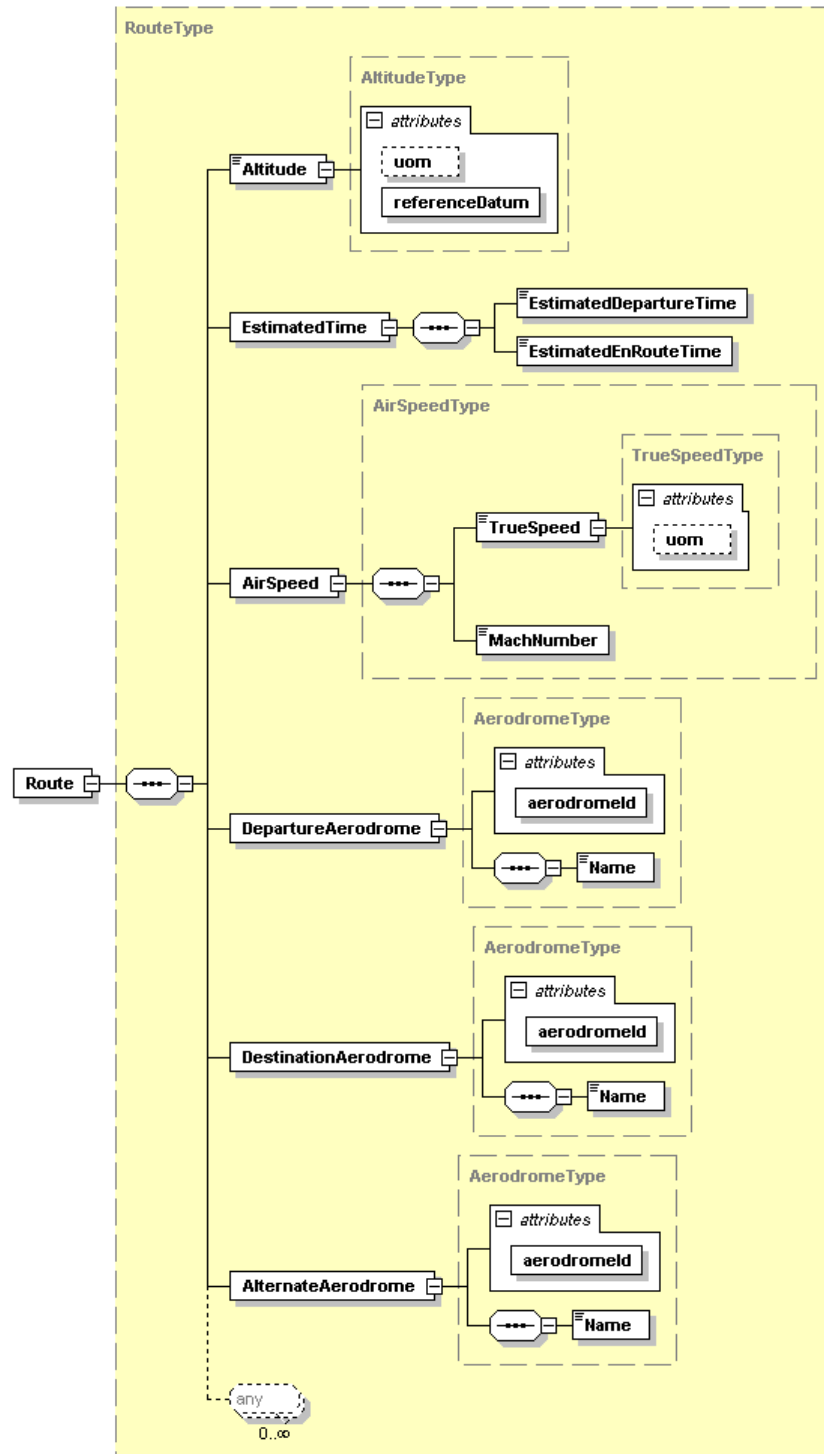
```
<xs:annotation>
  <xs:documentation>
    Values for aerodrome Ids are listed in ICAO Document 7910,
    Location Indicators, http://www.icao.int/eshop/index.html.
  </xs:documentation>
</xs:annotation>
<xs:sequence>
  <xs:element name="Name" type="xs:string"/>
</xs:sequence>
<xs:attribute name="aerodromeld" type="AerodromeldType" use="required"/>
</xs:complexType>
<xs:simpleType name="SpeedBase">
  <xs:restriction base="xs:decimal"/>
</xs:simpleType>
<xs:complexType name="TrueSpeedType">
  <xs:simpleContent>
    <xs:extension base="SpeedBase">
      <xs:attribute name="uom" type="UnitOfSpeedType" default="knots"/>
    </xs:extension>
  </xs:simpleContent>
</xs:complexType>
<xs:complexType name="AirSpeedType">
  <xs:sequence>
    <xs:element name="TrueSpeed" type="TrueSpeedType"/>
    <xs:element name="MachNumber" type="xs:decimal"/>
  </xs:sequence>
</xs:complexType>
<xs:simpleType name="AltitudeBase">
  <xs:restriction base="xs:nonNegativeInteger"/>
</xs:simpleType>
<xs:complexType name="AltitudeType">
  <xs:simpleContent>
    <xs:extension base="AltitudeBase">
      <xs:attribute name="uom" type="UnitOfAltitudeType" default="foot"/>
      <xs:attribute name="referenceDatum" type="ReferenceDatumType" use="required"/>
    </xs:extension>
  </xs:simpleContent>
</xs:complexType>
<!-- ////////// Code types ////////// -->
<xs:simpleType name="AerodromeldType">
  <xs:restriction base="xs:string">
    <xs:maxLength value="4"/>
    <xs:pattern value="[A-Z][A-Z][A-Z][A-Z]"/>
  </xs:restriction>
</xs:simpleType>
<!-- ////////// Enumerations types ////////// -->
```

```
<xs:simpleType name="FlightRuleType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="I"/>
    <xs:enumeration value="V"/>
    <xs:enumeration value="Y"/>
    <xs:enumeration value="Z"/>
  </xs:restriction>
</xs:simpleType>
<xs:simpleType name="WakeTurbulenceCategoryType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="H"/>
    <xs:enumeration value="HEAVY"/>
    <xs:enumeration value="M"/>
    <xs:enumeration value="MEDIUM"/>
    <xs:enumeration value="L"/>
    <xs:enumeration value="LIGHT"/>
  </xs:restriction>
</xs:simpleType>
<xs:simpleType name="ReferenceDatumType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="local"/>
    <xs:enumeration value="standard"/>
  </xs:restriction>
</xs:simpleType>
<!-- ////////// Units of Measurement enumerations ////////// -->
<xs:simpleType name="UnitOfSpeedType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="km/h"/>
    <xs:enumeration value="knots"/>
  </xs:restriction>
</xs:simpleType>
<xs:simpleType name="UnitOfAltitudeType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="m"/>
    <xs:enumeration value="meter"/>
    <xs:enumeration value="foot"/>
  </xs:restriction>
</xs:simpleType>
</xs:schema>
```

Appendix B. Schema of XML Representation – diagram



Fragment - Route element



Appendix C. Example of XML Representation of the Flight Plan Resource

```
<?xml version="1.0" encoding="UTF-8"?>
<FlightPlan xmlns="http://faa.gov/fpxm"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://faa.gov/fpxm fpxm.xsd"
  flightRule="I"
  numberOfAircraft="1"
  filingTime="2001-12-17T09:30:47Z" >
  <FlightPlanId xsi:nil="true" />
  <Originator airmanId="215336745">
    <Name>John Doe</Name>
  </Originator>
  <Aircraft aircraftType="PA-32R" aircraftId="JHB426E">
    <Equipage>
      <Communication>V</Communication>
      <Navigation>C</Navigation>
      <Surveillance>OL</Surveillance>
    </Equipage>
    <WakeTurbulenceCategory>LIGHT</WakeTurbulenceCategory>
  </Aircraft>
  <Route>
    <Altitude referenceDatum="local" uom="foot">7000</Altitude>
    <EstimatedTime>
      <EstimatedDepartureTime>14:20:00.0Z</EstimatedDepartureTime>
      <EstimatedEnRouteTime>PT3H30M</EstimatedEnRouteTime>
    </EstimatedTime>
    <AirSpeed>
      <TrueSpeed uom="knots">170</TrueSpeed>
      <MachNumber>0.12</MachNumber>
    </AirSpeed>
    <DepartureAerodrome aerodromeId="KBWI">
      <Name>Baltimore-Washington International, MD</Name>
    </DepartureAerodrome>
    <DestinationAerodrome aerodromeId="KBOS">
      <Name>Logan International Airport,Boston, MA</Name>
    </DestinationAerodrome>
    <AlternateAerodrome aerodromeId="KJFK">
      <Name>John F. Kennedy International Airport,NY,NY</Name>
    </AlternateAerodrome>
  </Route>
</FlightPlan>
```

Appendix D. WADL Document for FPS – fps.wadl

```
<?xml version="1.0"?>
<application xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:tns="urn:us:gov:dot:faa:example:atm:enroute:fps"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema"
  xmlns:fpxm="http://faa.gov/fpxm"
  xmlns:fps="urn:us:gov:dot:faa:example:atm:enroute:fps"
  xmlns="http://wadl.dev.java.net/2009/02"
  xsi:schemaLocation="http://wadl.dev.java.net/2009/02 wadl.xsd">
  <doc>
    This WADL document describes the FlightPlan service.
    Additional application-level information for use of this service
    is available in the WSDD Flight Plan Service document.
  </doc>
  <grammars>
    <include href="fpxm.xsd"/>
  </grammars>

  <resources base="http://esmg.faa.gov/dev/fps">
    <!-- //////////////////////////////////////
          File Flight Plan
    ////////////////////////////////////// -->
    <resource path="flight-plan">
      <method name="POST" id="FileFlightPlan">
        <doc>The FileFlightPlan operation uses the HTTP POST method to allow
          a user to create (file) a flight plan. </doc>
        <request>
          <representation id="FlightPlan"
            mediaType="application/xml"
            element="fpxm:FlightPlan" />
        </request>
        <response status="201">
          <doc>Response containing the information that flight plan has
            been accepted and filed and URI for the newly created flight
            plan has been returned.</doc>
          <param name="Location" style="header" type="xsd:anyURI">
            <doc>URI of newly filed file plan returned in Location header field</doc>
          </param>
        </response>
        <response status="400">
          <doc>The request is malformed; it does not pass validation
            and cannot be understood by the service.</doc>
        </response>
        <response status="401">
```



```
<doc>The user has not been properly authenticated and/or authorized
to perform requested operation.</doc>
</response>
</method>
<!-- //////////////////////////////////////
Retrieve Flight Plan
//////////////////////////////////// -->
<method name="GET" id="RetrieveFlightPlan">
  <doc>The RetrieveFlightPlan operation uses the HTTP GET method to
  allow a user to retrieve a flight plan.</doc>
  <request>
    <param name="FlightPlanID"
      type="fpxm:FlightPlanIdType"
      style="template" required="true"/>
  </request>
  <response status="200">
    <doc>The requested flight plan has been retrieved successfully.</doc>
    <representation mediaType="application/xml" element="fpxm:FlightPlan"/>
  </response>
  <response status="401">
    <doc>The user has not been properly authenticated and/or authorized to
    perform requested operation.</doc>
  </response>
  <response status="404">
    <doc>The requested flight plan has not been found.</doc>
  </response>
</method>

<!-- //////////////////////////////////////
Update Destination Aerodrome
//////////////////////////////////// -->
<method name="PUT" id="UpdateDestinationAerodrome">
  <doc>The UpdateDestinationAerodrome operation uses the HTTP UPDATE method
  to allow a user to update the destination aerodrome information in a flight
plan.</doc>
  <request>
    <representation id="FlightPlanWithNewDesctnation"
      mediaType="application/xml"
      element="fpxm:FlightPlan" />
  </request>
  <response status="200">
    <doc>The destination aerodrom for the flight plan has been updated
successfully.</doc>
    <representation mediaType="application/xml" element="fpxm:FlightPlan"/>
  </response>
  <response status="400">
```

```
<doc>The request is malformed; it does not pass validation and cannot
    be understood by the service.</doc>
</response>
<response status="401">
    <doc>The user has not been properly authenticated and/or authorized
        to perform requested operation.</doc>
</response>
<response status="404">
    <doc>The requested flight plan has not been found.</doc>
</response>
</method>
<!-- //////////////////////////////////////
        Delete Flight Plan
    ////////////////////////////////////// -->
<method name="DELETE" id="DeleteFlightPlan">
    <doc>The CancelFlightPlan operation uses the HTTP DELETE method
        to allow a user to cancel (logically delete) a flight plan.</doc>
    <request>
        <param name="FlightPlanID" type="xsd:string" style="template" required="true"/>
    </request>
    <response status="200">
        <doc>The requested flight plan has been deleted.</doc>
    </response>
    <response status="401">
        <doc>The user has not been properly authenticated and/or authorized
            to perform requested operation.</doc>
    </response>
    <response status="404">
        <doc>The requested flight plan has not been found.</doc>
    </response>
</method>
</resource>
</resources>
</application>
```

Appendix E. WSDL Document for FPS – fps.wsdl

```
<?xml version="1.0" encoding="utf-8"?>
<description targetNamespace="urn:us:gov:dot:faa:example:atm:enroute:fps"
  xmlns="http://www.w3.org/ns/wsdl"
  xmlns:whhttp="http://www.w3.org/ns/wsdl/http"
  xmlns:tns="urn:us:gov:dot:faa:example:atm:enroute:fps"
  xmlns:fpxm="http://faa.gov/fpxm"
  xmlns:wsoap="http://www.w3.org/ns/wsdl/soap"
  xmlns:soap="http://www.w3.org/2003/05/soap-envelope"
  xmlns:wsdlix="http://www.w3.org/ns/wsdl-extensions">
  <documentation>
    This WSDL document describes the FlightPlan service. Additional application-level
    information for use of this service is available in the WSDD Flight Plan Service document.
  </documentation>
  <!-- TYPES -->
  <types>
    <xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
      targetNamespace="urn:us:gov:dot:faa:example:atm:enroute:fps"
      xmlns="urn:us:gov:dot:faa:example:atm:enroute:fps"
      xmlns:fpxm="http://faa.gov/fpxm">
      <xs:import namespace="http://faa.gov/fpxm" schemaLocation="fpxm.xsd"/>
      <!--MESSAGES -->
      <!--FileFlightPlanRequest-->
      <xs:element name="FileFlightPlanRequest">
        <xs:annotation>
          <xs:documentation>
            The request message element for the operation FileFlightPlan.
          </xs:documentation>
        </xs:annotation>
      </xs:element>
      <!--FileFlightPlanResponse-->
      <xs:element name="FileFlightPlanResponse">
        <xs:annotation>
          <xs:documentation>
            The response message element for the operation FileFlightPlan.
          </xs:documentation>
        </xs:annotation>
      </xs:element>
      <!--RetrieveFlightPlanRequest-->
      <xs:element name="RetrieveFlightPlanRequest">
        <xs:annotation>
          <xs:documentation>
            The request message element for the operation RetrieveFlightPlan.
          </xs:documentation>
        </xs:annotation>
      </xs:element>
    </xs:schema>
  </types>
</description>
```

```
</xs:documentation>
</xs:annotation>
</xs:element>
<!--RetrieveFlightPlanResponse-->
<xs:element name="RetrieveFlightPlanResponse">
  <xs:annotation>
    <xs:documentation>
      The response message element for the operation RetrieveFlightPlan.
    </xs:documentation>
  </xs:annotation>
</xs:element>
<!--UpdateDestinationAerodromeRequest-->
<xs:element name="UpdateDestinationAerodromeRequest">
  <xs:annotation>
    <xs:documentation>
      The request message element for the operation UpdateDestinationAerodrome.
    </xs:documentation>
  </xs:annotation>
</xs:element>
<!--UpdateDestinationAerodromeResponse-->
<xs:element name="UpdateDestinationAerodromeResponse">
  <xs:annotation>
    <xs:documentation>
      The response message element for the operation UpdateDestinationAerodrome.
    </xs:documentation>
  </xs:annotation>
</xs:element>
<!--CancelFlightPlanRequest-->
<xs:element name="CancelFlightPlanRequest">
  <xs:annotation>
    <xs:documentation>
      The request message element for the operation CancelFlightPlan.
    </xs:documentation>
  </xs:annotation>
</xs:element>
<!--CancelFlightPlanResponse-->
<xs:element name="CancelFlightPlanResponse">
  <xs:annotation>
    <xs:documentation>
      The response message element for the operation CancelFlightPlan.
    </xs:documentation>
  </xs:annotation>
</xs:element>
<!--Bad Request-->
<xs:element name="BadRequest" type="xs:string">
  <xs:annotation>
```

```
<xs:documentation>
    The Fault message element, that represents HTTP 400 Bad Request response.
</xs:documentation>
</xs:annotation>
</xs:element>
<!--Unauthorized-->
<xs:element name="Unauthorized" type="xs:string">
    <xs:annotation>
        <xs:documentation>
            The Fault message element, that represents to HTTP 401 Unauthorized response.
        </xs:documentation>
    </xs:annotation>
</xs:element>
<!--Not Found-->
<xs:element name="NotFound" type="xs:string">
    <xs:annotation>
        <xs:documentation>
            The Fault message element, that represents to HTTP 404 Not Found response.
        </xs:documentation>
    </xs:annotation>
</xs:element>
</xs:schema>
</types>
<!-- INTERFACE -->
<interface name="FlightPlanInterface">

    <fault name="UnauthorizedFault" element="tns:Unauthorized" />
    <fault name="BadRequestFault" element="tns:BadRequest" />
    <fault name="NotFoundFault" element="tns:NotFound" />

    <operation name="FileFlightPlan"
        style="http://www.w3.org/ns/wsdli/style/iri"
        pattern="http://www.w3.org/ns/wsdli/in-out"
        wsdlx:safe="true">
        <documentation>This operation files flight plan.</documentation>
        <input element="tns:FileFlightPlanRequest" messageLabel="In"/>
        <output element="tns:FileFlightPlanReResponse" messageLabel="Out"/>
        <outfault ref="UnauthorizedFault" messageLabel="Out"/>
        <outfault ref="BadRequestFault" messageLabel="Out"/>
    </operation>
    <operation name="RetrieveFlightPlan"
        style="http://www.w3.org/ns/wsdli/style/iri"
        pattern="http://www.w3.org/ns/wsdli/in-out"
        wsdlx:safe="true">
        <documentation>This operation retrieves flight plan.</documentation>
        <input element="tns:RetrieveFlightPlanRequest" messageLabel="In"/>
```

```
<output element="tns:RetrieveFlightPlanResponse" messageLabel="Out"/>
<outfault ref="UnauthorizedFault" messageLabel="Out"/>
<outfault ref="BadRequestFault" messageLabel="Out"/>
<outfault ref="NotFoundFault" messageLabel="Out"/>
</operation>
<operation name="UpdateDestinationAerodrome"
  style="http://www.w3.org/ns/wsdli/style/iri"
  pattern="http://www.w3.org/ns/wsdli/in-out"
  wsdlx:safe="true">
  <documentation>This operation modifies flight plan.</documentation>
  <input element="tns:UpdateDestinationAerodromeRequest" messageLabel="In"/>
  <output element="tns:UpdateDestinationAerodromeResponse" messageLabel="Out"/>
  <outfault ref="UnauthorizedFault" messageLabel="Out"/>
  <outfault ref="BadRequestFault" messageLabel="Out"/>
  <outfault ref="NotFoundFault" messageLabel="Out"/>
</operation>
<operation name="CancelFlightPlan"
  style="http://www.w3.org/ns/wsdli/style/iri"
  pattern="http://www.w3.org/ns/wsdli/in-out"
  wsdlx:safe="true">
  <documentation>This operation cancels flight plan.</documentation>
  <input element="tns:CancelFlightPlanRequest" messageLabel="In"/>
  <output element="tns:CancelFlightPlanResponse" messageLabel="Out"/>
  <outfault ref="UnauthorizedFault" messageLabel="Out"/>
  <outfault ref="NotFoundFault" messageLabel="Out"/>
</operation>
</interface>
<!-- BINDING -->
<binding name="HTTPFlightPlanBinding"
  interface="tns:FlightPlanInterface"
  type="http://www.w3.org/ns/wsdli/http">
  <documentation>The RESTful HTTP binding for the FPS.</documentation>
  <operation ref="FileFlightPlan" whttp:method="POST"/>
  <operation ref="RetrieveFlightPlan" whttp:method="GET"/>
  <operation ref="UpdateDestinationAerodrome" whttp:method="PUT"/>
  <operation ref="CancelFlightPlan" whttp:method="DELETE"/>
</binding>
<!-- SERVICE -->
<service name="FlightPlanService" interface="tns:FlightPlanInterface">
  <documentation>Flight Plan Service.</documentation>
  <endpoint name="HTTPFlightPlanEndPoint"
    binding="tns:FlightPlanHTTPBinding"
    address="http://esmg.faa.gov/dev/flight-plan/" />
</service>
</description>
```